



BSI Standards Publication

Child care articles — General safety

Part 2: Mechanical hazards

National foreword

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ISO/TS 24929-2

Child care articles — General safety —

Part 2: Mechanical hazards

*Articles de puériculture — Sécurité générale —
Partie 2: Risques mécaniques*

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 310, *Child care articles*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Child care articles — General safety —

Part 2: Mechanical hazards

1 Scope

This document specifies requirements and gives guidance on mechanical hazards for developing safety standards for child care articles which are intended for children from birth to 48 months.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 ageing

change of properties of a material due to exposure to environmental factors

Note 1 to entry: Environmental factors can include temperature, humidity, ultra-violet (UV) radiation, and cleaning agents.

3.2 completely bound opening

opening that is continuously surrounded on all sides by the material of a product

EXAMPLE See [Figure 2](#).

3.3 crotch restraint

device designed to be positioned between a child's legs to prevent the child from sliding forward

3.4 harness anchorage point

attachment point suitable for the attachment of an additional child's safety harness

3.5 irregular-shaped opening

opening that does not have a symmetrical shape

EXAMPLE See [Figure 5](#).

3.6

locking device

mechanical component that maintains one or more parts of a product when erected in the position of use (e.g. latches, hooks, over centre lock) which can be activated or deactivated by one or more actions on the *operating device* ([3.10](#))

3.7

locking mechanism

assembly of components consisting of one or more *locking devices* ([3.6](#)) and one or more *operating devices* ([3.10](#))

3.8

mechanical hazard

physical factor which can give rise to injury due to the mechanical properties of products/product parts

3.9

mechanical wear

change of mechanical properties due to fatigue or repeated operation of devices, mechanisms and other parts of a product

3.10

operating device

part of one or more *locking mechanisms* ([3.7](#)) designed to be activated by a carer through one or several positive actions

3.11

partially bound opening

opening that is partially surrounded by the material of a product

EXAMPLE See [Figure 3](#).

3.12

reach envelope

age-related physical data on the reach limits of the limbs of children in different postures

Note 1 to entry: See [6.2](#).

3.13

restraint system

system to restrain a child within a product

3.14

shoulder restraint

device passing over a child's shoulders and connecting either to the *crotch restraint* ([3.3](#)) or to the *waist restraint* ([3.16](#))

3.15

V-shaped opening

opening where there is a slot that narrows towards the bottom

EXAMPLE See [Figure 4](#).

3.16

waist restraint

one or more rigid or flexible devices, which, when fastened, go from one side of a product to the other, passing in front of a child's waist or surrounding a child's waist

4 General requirements and test conditions

4.1 Tolerances for test equipment

Unless otherwise stated, the accuracy of the test equipment used in this document shall be:

- forces $\pm 5\%$;
- masses $\pm 0,5\%$;
- dimensions $\pm 0,5\text{ mm}$;
- timing $\pm 1\text{ s}$;
- angles $\pm 0,5^\circ$.

4.2 General test conditions

The sample shall be conditioned at a temperature of $(22 \pm 5)^\circ\text{C}$ for at least 2 h prior to tests. All tests shall be carried out at a temperature of $(22 \pm 5)^\circ\text{C}$ unless otherwise specified.

5 Mechanical hazards — Safety philosophy

This clause addresses the most widely known mechanical hazards and provides guidance for drafting standards for child care articles.

Anthropometric data and information on the abilities of children related to risks are given in ISO/TS 24929-1:—¹⁾, Annex A. When using these data for setting requirements, adequate safety margins should be considered. These data refer to static and non-dynamic anthropometric data, therefore care should be taken if using these data for anything other than static situations when drafting standards.

When drafting standards, conditions of use should be considered, bearing in mind the behaviour of children, as well as whether the child is attended or unattended when using the product and the child's access to hazardous features.

The reasonably foreseeable conditions of use should always be considered when designing children's products and/or developing product standards.

For each mechanical hazard described in this document a rationale is given, explaining the potential hazard to the child. Requirements, test equipment and test methods are also given. Where appropriate, these can be used when drafting standards.

New technologies (e.g. fingerprint, face recognition) can be used for opening and closing a mechanical device or operating a product. There should always be a mechanical back-up system so that a person can operate the product, especially in an emergency or if the power source fails.

For example, automatic closing/opening doors using fingerprint, face recognition, remote control, etc. should have a manual backup to operate the door in order to rapidly remove the child from the product in case the automatic system fails to work.

When developing technical standards for child care articles, if these new technologies are identified as a possible option for use within a product category, specific requirements and test methods to assess their safety should be defined.

1) Under preparation. Stage at the time of publication: ISO/CD TS 24929-1:2024.

6 Accessibility of mechanical hazards

6.1 General

This document does not specify exact areas of access (also known as access zones) as these should be determined in relation to the hazards and risks of individual products and risks when drafting specific product standards. The following examples show a general guidance of contact associated with mechanical hazards:

- The hazardous part of a product is in reach of the child from the intended position of use in particular by head, mouth, hands or feet and there is a high probability for frequent, intensive and/or prolonged contact. Requirements should address this primary contact.
- The hazardous part of a product can be reached by the child or any other child beyond the intended position of use. The product is considered to remain in its intended position(s). Access to hazardous parts is gained by passing/moving around the product or when proceeding to the intended position. The risk of harm deriving from frequent, intensive and/or prolonged contact is likely to be less probable.
- The hazardous part of a product exists but cannot be reached by any child.

6.2 Accessibility areas

Accessibility areas of children are relevant to their age. To determine accessibility areas in connection with age groups, refer to the reach envelope in CEN/TR 13387-3.

6.3 Product information

In order to ensure mechanical safety, product information should include appropriate instructions and warnings. For example:

- the need for one or more restraint systems and their adjustment;
- the opening and closing of products;
- the operation of safety locks for foldable parts;
- the method of attachment to fixed structures or to other products.

Instructions should also inform the carer of the need to inspect the product regularly and also to use only replacement parts that are approved by the manufacturer/supplier.

ISO/TS 24929-5²⁾ gives detailed advice concerning the presentation of product information.

7 Entrapment hazards

7.1 General

To avoid entrapment of head, neck, hands, fingers and feet, safety distances are recommended in relation to the anthropometric data of the growing child (see ISO/TS 24929-1:—, Annex A). It is important to take into account the intended age and/or development level of the child. As a priority, those parts of a product which are accessible when a child is using the product as foreseeable should be considered. It may also be appropriate for gaps and openings beyond these accessible areas to be addressed. Gaps and openings which are inaccessible may be ignored. However, V-shaped openings or V-shaped arrangements of structural members should be avoided.

2) Under preparation. Stage at the time of publication: ISO/AWI TS 24929-5:2024.

Important entrapment hazards to avoid are:

- entrapment of the neck in situations where the child is incapable of raising its body weight to relieve the pressure (e.g. a crawling child on the outside of a play pen, V-shapes);
- entrapment of the neck in situations where the child slips through a gap feet first (e.g. a child slipping between bars/slats);
- entrapment of fingers, which can cause a loss of blood supply to the fingertips.

If it is possible to position a child care article next to other furniture or a wall and create an entrapment hazard between them, an instruction should be included to warn carers of this possible entrapment hazard. When considering entrapment hazards, dynamic situations should be considered as well as static hazards. A dynamic situation will increase the force being applied to a trapped part of the body through the mass, movement or momentum of the child, which will increase the risk of injury.

To assist with this, an entrapment matrix is given in [Figure 1](#), which was based on work done in ISO/IEC Guide 50. This entrapment matrix does not impart any hierarchy in the severity of the hazards shown and the specific hazard clause/subclause should be referred to.

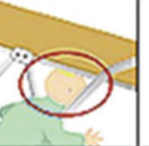
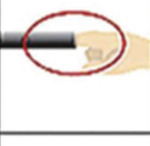
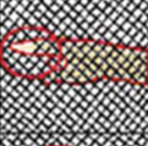
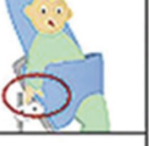
Body part	Completely bound openings		Partially bound openings	V shapes	Protusions	Moving parts of equipment
	Rigid	Non-rigid				
Whole body						
Head neck, head first						
Head neck, feet first						
Arm and hand						
Leg and foot						
Finger						
Clothing						

Figure 1 — Examples of entrapment and entanglement in gaps

7.2 Entrapment of head and neck

7.2.1 Rationale

Entrapment of the head and neck hazards occur when the child is in a position where its body weight is supported by its neck and the child is incapable of lifting its body weight to relieve pressure on its neck. When this occurs, it will cause airways to close and restrict the blood flow, leading to brain damage.

The risk of head and neck entrapment increases as the child's mobility and ability increases, enabling the child to access a wider range of hazards and products. The hazard is directly related to the size of the child's head and hips.

The hazard can be avoided by limiting the size and shape of completely bound, partially bound, V-shaped and irregular-shaped openings (for examples, see [Figures 2](#) to [5](#)).

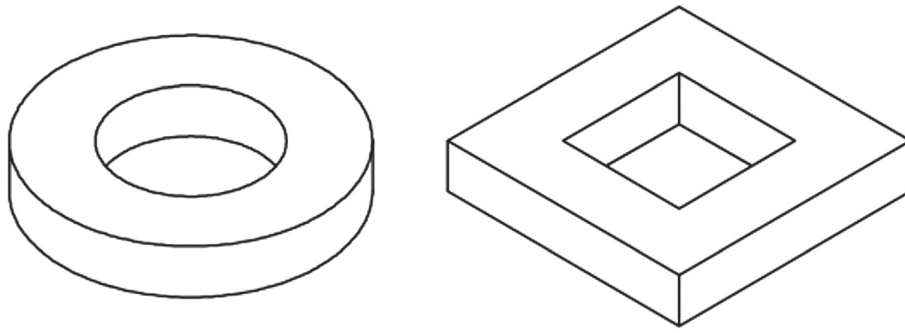


Figure 2 — Examples of completely bound openings

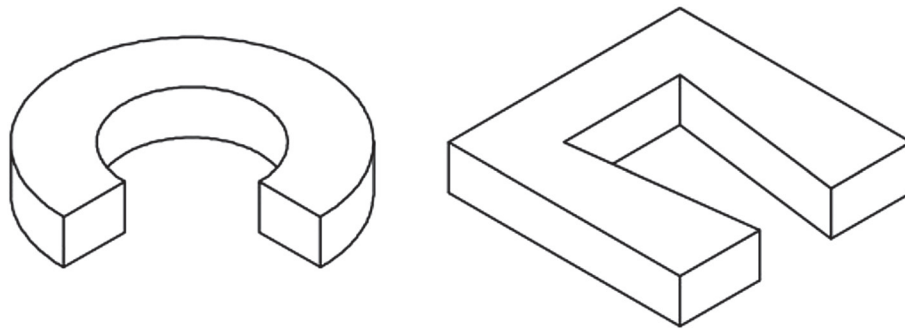


Figure 3 — Examples of partially bound openings

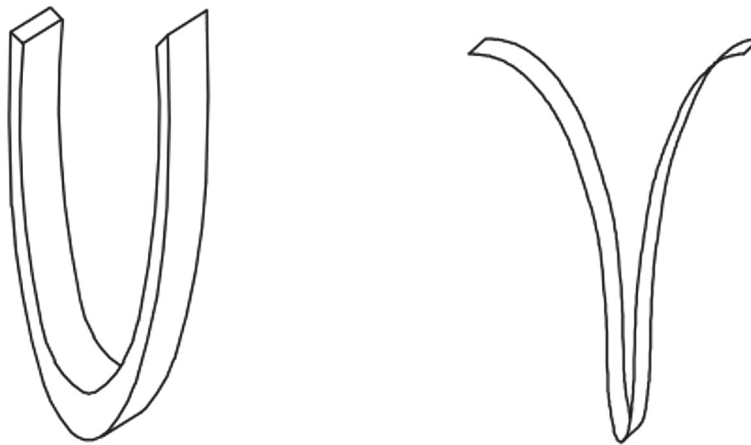


Figure 4 — Examples of V-shaped openings

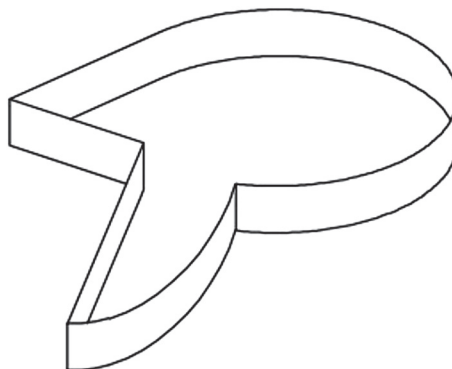


Figure 5 — Example of an irregular-shaped opening

7.3 Requirements

When tested in accordance with [7.5.1](#) or [7.5.2](#), if openings allow passage of the small probe, the large probe shall pass through. The opening that allows the large probe to pass completely through shall comply with the requirement for partially bound, V-shaped and irregular-shaped openings when tested in accordance with [7.5.3](#).

Partially bound, V-shaped and irregular-shaped openings shall be constructed so that:

- portion B of the template does not enter the opening when tested in accordance with [7.5.3](#) (see [Figures 10](#) and [11](#)); or
- the apex of portion A of the template contacts the base of the opening when tested in accordance with [7.5.3](#) (see [Figure 12](#)).

7.4 Test equipment

7.4.1 Probe philosophy

To cover all aspects of head and neck entrapment four types of probes are required: hip probe ([7.4.1.1](#)), small head probe ([7.4.1.2](#)), large head probe ([7.4.1.3](#)) and template for partially bound and V-shaped openings ([7.4.1.4](#)). These probes are made of a rigid material with a smooth finish. The size of individual probes is determined to meet the age range of the child (see the figures and tables for the various probes).

The following test equipment shall be used.

7.4.1.1 Hip probe (see [Figure 6](#)), which represents the hip of the smallest child in each age range. The probe size corresponds to the size of the child as follows:

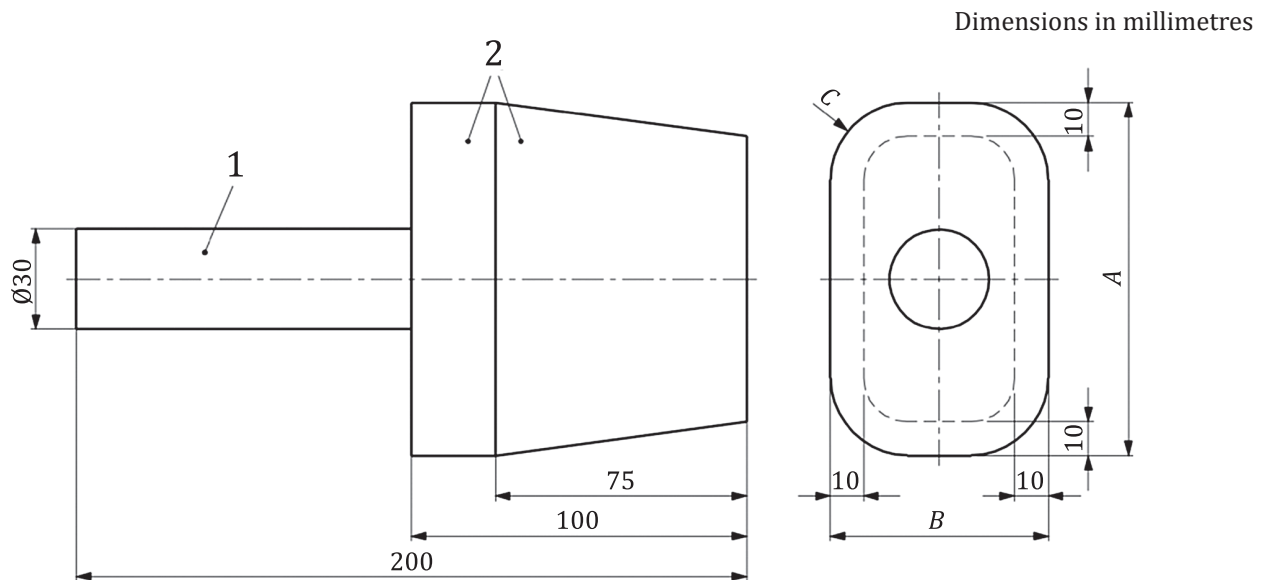
- dimension “A” represents the hip breadth;
- dimension “B” represents hip depth;
- dimension “C” represents the radius C after calculation based on hip circumference.

The dimensions of the hip probe are based on the anthropometric data (see ISO/TS 24929-1:—, Annex A), see [Table 1](#).

Table 1 — Hip probe corresponding to smallest child

Dimensions in millimetres

Age months	Hip breadth (A)	Hip depth (B)	Calculation based on hip circumference (C)
0 to 2	101	42	10
3 to 5	105	65	23
6 to 8	124	67	23

**Key**

- 1 handle
- 2 hip probe
- A hip breadth
- B hip depth
- C calculation based on hip circumference

Figure 6 — Hip probe

7.4.1.2 Small head probe (see [Figure 7](#)), which represents the head of the smallest child in each age range. The probe size corresponds to the child size as follows:

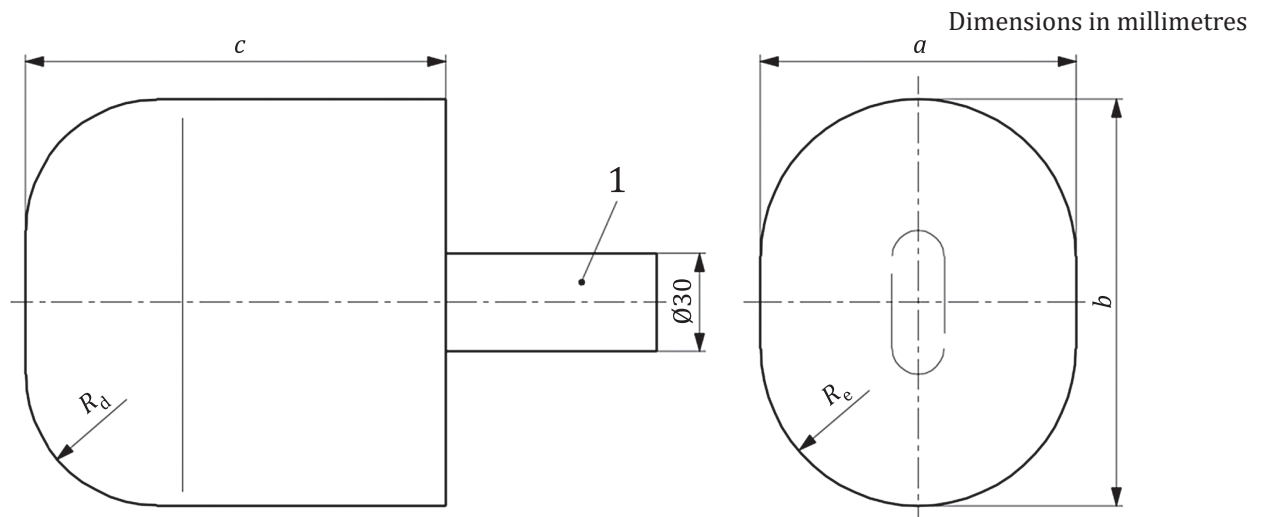
- dimension “a” represents head breadth;
- dimension “b” represents head length;
- dimension “c” represents head height;

The dimensions of the small head probe are based on anthropometric data (see ISO/TS 24929-1:—, Annex A), see [Table 2](#).

Table 2 — Head probe corresponding to smallest child

Dimensions in millimetres

Age months	Head breadth (a)	Head length (b)	Head height (c)	Re	Rd
0 to 3	96	124	112	48	40
3 to 6	101	137	119	50,5	40
6 to 9	106	145	126	53	40
9 to 12	111	150	138	55,5	40
12 to 18	115	155	144	57,5	40
18 to 24	118	158	149	59	40
24 to 36	120	159	154	60	40
36 to 48	123	161	156	61,5	40

**Key**

1	handle
a	head breadth
b	head length
c	head height
Re/Rd	radii

Figure 7 — Small head probe

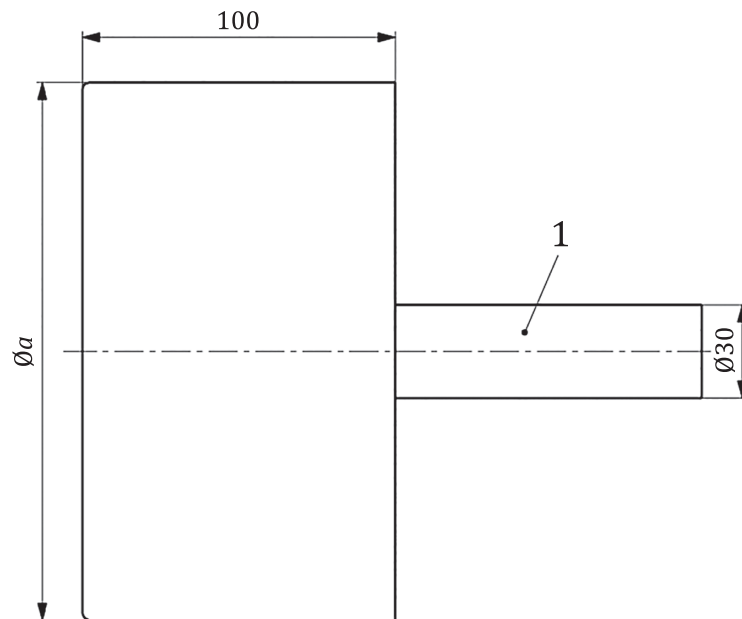
7.4.1.3 Large head probe (see [Figure 8](#)), which represents the head of the largest child in the age range. The probe size corresponds to the child size as follows:

— dimension “a” represents chin to crown length.

The dimensions of the large head probe are based on the anthropometric data (see ISO/TS 24929-1:—, Annex A), see [Table 3](#).

Table 3 — Head probe corresponding to largest child

Age months	Chin to crown length (diameter “a” in mm)
0 to 3	175
3 to 6	191
6 to 9	196
9 to 12	205
12 to 18	210
18 to 24	215
24 to 36	223
36 to 48	229



Key

- 1 handle
- a chin to crown length

Figure 8 — Large head probe

7.4.1.4 Template for partially bound and V-shaped openings.

The template shown in [Figure 9](#) represents head and neck dimensions.